cannot be compared in full detail with that of neighbouring countries.

There are one or two slips; for example, "right hand rear section" on page 179 should be "right hand front section." The diagram in Fig. 2 is not sufficiently explained to be intelligible to those readers who are not already familiar with the theories of Prof. Bjerknes. The glossary at the end is not very full: we look in vain, for example, for orographical rain and for convection. The book fills a gap in meteorological literature, and the concluding chapter on the economic application of rainfall data is an indication of how widely it should be studied, not only by meteorologists, but also by those outside their ranks.

(2) "Etudes élémentaires de Météorologie pratique" describes the ideal arrangement of stations for a meteorological service, the instruments used, including captive balloons, pilot balloons, and aeroplanes, and the general procedure of such stations. Part 2 is devoted to problems of pressure and wind, and part 3 discusses forecasting. Squalls and thunderstorms come in for full treatment, and also the sudden clearings of the sky, "éclaircies"; the author's experience as chief of the meteorological service of the Armies of the Centre probably led him to study this phenomenon, so important for aviation and hitherto much neglected. The author advocates numerous observation posts, so that a line squall, for instance, may not pass unnoticed between the regular stations of the service. If such a system had been adopted in this country during the war much serious damage might have been avoided at aerodromes in the South of England. The work does not pretend to be a meteorological handbook, but it is valuable for those engaged in official meteorological work, and it discusses interesting points, some of which may still be rather controversial. The chief fault of the work, if fault it be, is that it is unnecessarily full, which would have made an index all the more useful.

(3) Mr. Stenhouse's little book is intended for school students and for the general reader. The subject, including something of dynamic meteorology, is shortly and clearly explained. But there are a number of inaccuracies which ought to be corrected if the work runs into further editions. The coldest time of day is not a little after midnight but a little before sunrise; strato-cumulus is scarcely a combination of stratus and cumulus, nor is cumulus the typical cloud of the middle layer. Alto-cumulus is not even mentioned; and the distinction between cloud sheets and clouds of convection is not brought out. There are some good photographs, but they have not been well selected; snow and frost scenes do not teach anything in particular, and a more typical selection of cloud forms should have been given; the clouds in Plate VI., though given as cumulus, are nothing of the kind; the top picture in Plate VII. has been inverted. The diagrams of sections across weather maps make a misleading use of the term pressure-gradient. In spite of faults, however, the book forms an attractive introduction to meteorology for beginners.

(4) Unfortunately this cannot be said for Mr. Redway's "Handbook of Meteorology," which contains many inaccurate statements. Hydrogen, on account of its lightness, is stated to be thrown off into space by the rapid movement of the earth; air currents "are deflected by the rotation of the earth on its axis easterly in tropical latitudes, and westward beyond the tropics"; the isothermal layer separates the stratosphere and the troposphere; the stratosphere is stated to be radioactive, indicating the presence of electrified dust particles, and the reason why cloud particles remain suspended is stated to be unknown, and electrification is suggested as a possible explanation; these are only a few of the surprising statements to be found in this work.

C. J. P. Cave.

Freshwater Ciliate Infusoria and Heliozoa.

(1) *Etudes sur les Infusoires d'Eau douce.* By Dr. E. Penard. Pp. 331. (Genève: Georg et Cie, 1922.)

(2) *The British Freshwater Rhizopoda and Heliozoa.* By J. Cash and G. H. Wailes. Assisted by J. Hopkinson. Vol. 5. *Heliozoa.* By G. H. Wailes. Pp. vi+72+11 plates. (London: for the Ray Society, 1921.)

(1) THERE is probably no large sheet of fresh water that has been so thoroughly investigated, so far as its fauna of protozoa is concerned, as the Lake of Geneva. Forel, Jean Roux, Penard, and others have shown its richness in variety of form, in the number of species, in cases of parasitism, and in adaptations to other special habits of life. They have set an example which we might well follow in regard to our English lakes, about which we still know so little.

Dr. Penard has already published massive volumes on the Rhizopoda, the Heliozoa, and the Acinetaria of the lake and neighbouring waters, and the present volume on the ciliate Infusoria, not restricted in this case to protozoa of the immediate locality, is no less imposing than the others.

Dr. Penard's work will doubtless meet with a great deal of severe criticism, because his histological methods are primitive and inefficient, his illustrations badly drawn and abominably reproduced, and the arrangement of the text is most inconvenient for the reader. But he disarms criticism, to some extent, as regards the first defect by his frank admission that all his observations have been made on the living organisms, and that only in certain cases has he used some *intra vitam* stains for special purposes. It is a grievous pity, however, that with such interesting material passing through his hands he has not been able to employ an artist to provide at least a few illustrations of the same delicacy and accuracy as those to be found in the works of Jean Roux. There is not a single one of the three hundred figures that can be said to be a good picture of a living infusorian. They are all crude and inaccurate diagrams.

But these serious defects must not be allowed to obscure the fact that there are recorded in this volume many very interesting and important observations on the natural history of these protozoa. The detailed account, for example, of the explosion of the large trichocysts of *Microthorax haliodiscus*, the description of the conjugation and gemmation of the new Heterotrich *Strombilidium gyrans*, the discovery of the formation of small copulation buds in Cothurnia, and many other records of the author's observations are really valuable contributions to knowledge, and suggest at any rate interesting lines of research for some one who can use more modern methods of technique.

Dr. Penard proposes to add to our lists the names of several new genera and many new species; but it seems very doubtful if these new genera and species can be established until a better and more trustworthy account of the nuclei and other details of structure can be provided. Any one who has had experience of investigations of these active minute organisms must be aware of the uncertainty of observations on the form and structure of the meganuclei that are made when the animals are still living. Such observations must be confirmed and extended by a study of properly fixed and stained preparations before they can be regarded as trustworthy. More particularly is this the case with the micronuclei, which are usually quite invisible during life and require the best technical methods for their complete elucidation; and we may note, in this connection, that the author does not mention either the sixteen micronuclei of *Bursaria truncatella* or the single but remarkably conspicuous micronucleus of *Spirochona gemmipara*.

In a group of animals such as the Ciliata, which possess so few trustworthy characters for systematic work and vary so much as regards these characters according to environmental conditions, the systematist should not be satisfied with his description of new species until every important character that can be seen by the ordinary methods of research has been seen and described. If microscopists pass from the description of one species of Ciliata to that of another before the nuclear structures of the first have been determined, as Dr. Penard has done, our literature, already overburdened with unnecessary specific names, will soon become most hopelessly perplexing and cumbersome.

Dr. Penard's work will be useful for reference, and perhaps suggestive of lines for further investigations by other methods of research, but it cannot be regarded as one that excites great confidence.

(2) The new volume on the freshwater Heliozoa of the British Isles published by the Ray Society gives a record of genera and the species that have been found by microscopists in this country who have been interested in the group, but it does not do justice either in text or plates to the important morphological features or to the beauty of form that these remarkably interesting protozoa possess.

It is very disappointing that in this monograph the general account of the structure and reproduction of the Heliozoa is so incomplete. For example, in the very slight treatment of the reproduction of Actinophrys and Actinosphærium there is no reference to the works of Schaudinn or R. Hertwig. It seems extraordinary also that those who are responsible for the publications of the Ray Society have no better methods to suggest to the young microscopist for the preservation of these delicate organisms than 5 per cent. carbolic acid, formalin, and methylated spirit, and that no methods at all are given for staining preserved specimens to bring out more clearly the structure of the nuclei and other minute details.

The purely systematic part of the work is more satisfactory, and the microscopist will find a short but clear description of all the species that have been recorded in this country with references to many of the more important papers in the literature of the subject. Of the eighteen text-figures only two seem to be original, the others being either reproductions of the coarse and lifeless illustrations in Penard's monograph or taken from other authors. Figures such as these, in which the detailed structure is not clearly or accurately shown, do not incite to careful and patient study, although they may assist to some extent in the identification of species. The illustrations in the plates also, with a few exceptions, are far below the standard we might reasonably expect in the publications of the Ray Society. They do not represent these beautiful little organisms as spherical in shape with radiating pseudopodia on the whole circumference, but rather as flat discs with the pseudopodia in one plane.

Another fault which seems to be unpardonable in a work of this kind is the failure to give any description or descriptive lettering of the figures to assist the reader. In such a figure as that on p. 44, for example, it is impossible to determine which of the several circles in the endoplasm of Pompholyxophrys is the nucleus and what the other things are supposed to represent. And again, in the illustrations of *Actinophrys sol* on Plates 67 and 72 there is no explanation of the different forms of the body and its pseudopodia that are represented. A few lines on the opposite page giving the reason why six different drawings of this one species are shown on the first of these two plates would have added immensely to the value and interest of the account of the species.

S. J. H.

Our Bookshelf.

Organic Syntheses: An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Vol. 1. Pp. viii+84. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1921.) 8*s.* 6*d.* net.

In preparing materials for use in research work in organic chemistry, much difficulty is experienced and time wasted because adequate directions are not available. Moreover, the methods finally adopted are not often published, so that the work involved in discovering how to make the preparation successfully is lost, and may be repeated indefinitely in different laboratories. The present volume is the first annual instalment of a record of methods of proved merit, given in sufficient detail to ensure easy repetition; the methods given have been tested by being carried out from the instructions in a different laboratory from that in which these were drafted. The substances dealt with in the first volume are alkyl bromides, allyl alcohol, benzinesulphonic chloride, benzil, benzilic acid, benzoin, α-bromonaphthalene, *p*-bromophenol, diacetone alcohol, furfurol, mesityl oxide, methylene iodide, methylhexyl carbinol, oxalic acid, thiophenol, trimethylamine, and trimethylamine hydrochloride. In future volumes it is hoped to include preparations worked out in other countries and tested by repetition in one of the four American laboratories which are responsible for the organisation of the scheme.

The preparation of materials such as these in quantities of from 200 to 2000 grams offers a unique opportunity for determining their physical constants by exact methods, *e.g.* a determination of freezing points to 0·01° by means of a standardised thermometer recording the temperature of 100 grams or more of purified material, instead of to about 1° by the use of a milligram of material in a capillary tube attached to a thermometer of unknown errors. This useful development of the work may perhaps be looked for in the later volumes of the series.

T. M. L.

Exploitation du Pétrole par Puits et Galeries. By Paul de Chambrier. Pp. 106. (Paris: Librarie Dunod, 1921.)

In February 1921 a paper was read before the Institute of Petroleum Technologists on the working of petroleum by means of shafts and galleries, being an abstract from a pamphlet entitled "Exploitation du pétrole par puits et galeries," written by Prof. Paul de Chambrier. This pamphlet has recently come to hand, and it discusses at some length the methods employed more particularly at Péchelbronn, Alsace, in a bold attempt made to extract oil from certain horizons already exhausted by the drill.

The publication of the paper in this country created very considerable interest and even controversy at the time, and opinion was much divided as to the possibility of extending such methods to other fields. The pamphlet in its original form, however, makes most interesting reading, and there is no doubt that under certain specialised circumstances recourse may be had to this form of mining petroleum with decided probability of success. Such circumstances occur when (1) the producing bed has been drained so far as boring permits, (2) when there is an absence of gas under pressure, and (3) when the percentage of oil remaining in the bed is high enough to warrant the attempt being made. One may add a further condition, namely, that the bed does not lie at too great a depth from the surface.

The author contends that these methods allow the extraction of anything from two to five times the amount of oil obtainable by boring, and their ultimate employment, where possible, considerably enhances the economic value of the property. While these contentions may be quite justified commercially, it is open to doubt whether, from the scientific point of view, this practice will yield solutions to the fundamental questions of origin, migration and accumulation of petroleum, as indicated in the concluding paragraphs, but we recommend the careful perusal of the pamphlet before adverse criticism of this new departure be indulged in by either academic or technical expert.

H. B. Milner.

The Chemistry of the Garden: A Primer for Amateurs and Young Gardeners. By H. H. Cousins. Macmillan's Primers. Revised Edition. Pp. xxxi+147. (London: Macmillan and Co., Ltd., 1921.) 2*s.* net.

The new edition of Mr. Cousins's well-known little book will be welcomed by all who are interested in their gardens. In spite of the vast number of gardening books and the fact that it was first written twenty-three years ago, this book still remains one of the most useful guides that can be put into the hands of the amateur. Horticultural research does not move very quickly, and there has been less necessity for recasting than if the book had dealt with agriculture. Fuller investigation would no doubt cause modification in some of the recommendations made, but until it has been carried out the advice stands as the safest that can be given at present. Above all, its basis is sound. "I appeal," says the author, "to the gardeners of England to place themselves in line with the only true and sound method known to science, and the only safe and sure means to progress and discovery—experiment."

A Course of Practical Physiology for Agricultural Students. By J. Hammond and E. T. Halnan. Pp. 106. (Cambridge: At the University Press, 1920.) Price 4*s.* 6*d.* net.

This small book, which is not illustrated, contains exercises mainly in elementary histology for second-year students taking the course in agriculture at the University of Cambridge. Space is afforded for notes and drawings. The book will save time and labour for both student and teacher without disadvantage, as it does not pose as a text-book.